CASIO®

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ELECTRONIC CALCULATOR
CALCULADORA ELECTRONICA

CASIO BF-100

OPERATION MANUAL
MANUAL DE OPERACION

Thank you very much for purchasing our electronic calculator with 6 built-in financial calculation functions.
This instruction manual explains the fundamental methods for the use and handling of the calculator. Please read it carefully so that you may fully understand all of the various functions.

Please notify us of any errors or omissions you find in this manual. We cannot be responsible for damage or loss resulting from the information contained herein, use of calculation examples, misprints or omissions.

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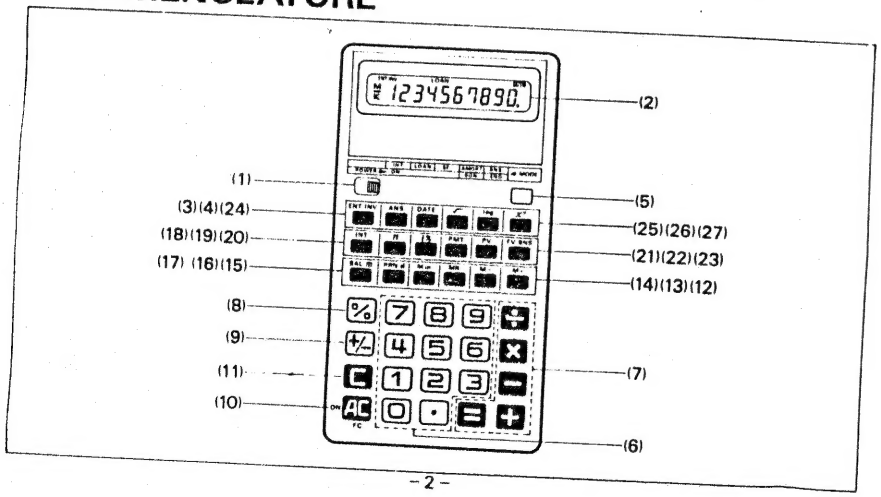
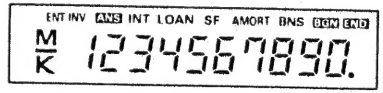
1/NOMENCLATURE



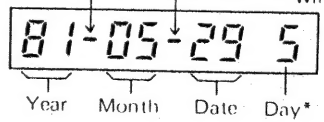
(1) Power switch

Move the slide switch to the right to turn the power ON. The independent memory and mode designation for financial calculation will be retained even after the power is turned OFF.

(2) Display



The display shows input data, intermediate results and results of operation.
A date is displayed as follows:



[Indicating May. 29 (Fri.), 1981.]

*

0	1	2	3	4	5	6
Sun.	Mon.	Tue.	Wed.	Thu.	Fri.	Sat.

"E" (error check, see page 12) may be displayed in the position of the least digit.
In financial calculations, "INT", "LOAN", "SF", "AMORT", "BNS", "BGN" and/or "END" will be displayed to indicate the operating mode, "ENT/INV" to indicate the condition available for data input, and "ANS" to indicate the condition available for result output.
"M" will be displayed when data is stored in the independent memory.
"K" will be displayed during calculation with constants.

(3) ENT INV Entry/Inverse key

- When entering data, press this key just prior to pressing each key. **(Symbolized here as ENT)**
- When activating the functions printed in orange on the keyboard, press this key just prior to pressing each key. **(Symbolized here as INV)**

(4) ANS Answer key (Symbolized here as ANS)

For financial calculations, to find the answer, press this key just prior to pressing each key.

(5) MODE Mode key (Symbolized here as MODE)

- Press this key to choose the proper mode for financial calculations (INT, LOAN, SF, AMORT, BNS). When this key is pressed, the mode will change in sequence from INT to LOAN to SF to AMORT to BNS to INT. Selected mode will be displayed when the key is pressed.
- If MODE key is pressed following the INV key, Beginning of Period Payment (BGN) or End of Period Payment (END) will be selected and displayed.

* Any mode may be used when performing basic calculations.

(6) 0 – 9, . Numeral and decimal point keys

To enter numerals, press these keys.
For decimal places, press the . key in its logical sequence.

(7) +, −, ×, ÷, = Four basic calculation and equal keys

When performing four basic calculations, press these keys. The = key obtains an answer.

* Constant calculations will be performed by pressing each key (+, −, × or ÷) twice successively. (See page 13.)

(8) % Percent key

When performing percentage calculations, press this key.

(9) +/− Sign change key

When changing the sign of displayed number from plus to minus and vice versa, press this key.

(10) ON AC FC All clear/Financial calculation clear key

- Press this key to clear all data except independent memory and financial calculating value. Also press for display when display is blank as a result of the Auto Power Off Function (Automatic Power Saving Function. . . . . see page 12).
- For financial calculation, prior to beginning to calculate, press INV FC to clear total value memory.

(11) C Clear key
When clearing entry for correction, press this key.

(12) M+ Memory plus key (Symbolized here as M+)
Press this key when adding displayed number to the contents of the independent memory. It has the same function as that of the = key; it obtains an answer in four basic calculations and automatically add the answer to the contents of the memory.

(13) M− Memory minus key (Symbolized here as M−)
Press this key when subtracting displayed number from the contents of the independent memory. It obtains an answer in four basic calculations and automatically subtracts the answer from the contents of the memory.

(14) MR Memory recall key (Symbolized here as MR)
Press this key when recalling the contents of the independent memory without clearing.

(15) Min Memory entry key (Symbolized here as M=)
Press this key when storing displayed number to the independent memory. Old data held in the memory will be automatically cleared.

(16) PRN d Principal/Number of days key
- To calculate the principal portion of an amortized loan, press this key following the ANS key. This key will only be used to calculate equal periodic payments in the AMORT mode. **(Symbolized here as PRN)**
- When inputting the number of days from the date of loan to the date of the first payment, press this key following the ENT key. This key will only be used to perform bonus payment in the BNS mode. **(Symbolized here as d)**

(17) BAL n Balance/Number of months key
- To find the remaining blance, press this key following the ANS key. **(Symbolized here as BAL)**
- When inputting the number of months from the month of loan to the first bonus payment month, press this key following the ENT key. This key will only be used to perform bonus payment in the BNS mode. **(Symbolized here as n)**

(18) INT Interest key
When inputting interest, press this key following i.
To find interest, press following ANS. **(Symbolized here as INT)**

(19) n Number of periods key
When inputting number of periods, press this key following ENT.
To find number of periods, press following ANS. **(Symbolized here as n)**

(20) $i\%$ Interest rate key

When inputting interest rate, press this key following [ENT].
To find interest rate, press following [ANS]. **(Symbolized here as [i%])**

(21) PMT Payment key

When inputting monthly payment amount, press this key following [ENT].
To find monthly payment amount, press following [ANS].
When using this key, the number of periods, interest rate, etc. must be on a monthly basis.
(Symbolized here as [PMT])

(22) PV Present value key

When inputting original amount, present value or amount borrowed, press this key following [ENT].
To find original amount, present value or amount borrowed, press following [ANS].
(Symbolized here as [PV])

(23) FV BNS Future value/Bonus key

- When inputting future value (total future value of principal plus interest), press this key following [ENT].
  To find future value, press following [ANS]. **(Symbolized here as [FV])**
- When inputting bonus payment, press this key following [ENT]. This key will only be used to perform bonus payment in the BNS mode. **(Symbolized here as [BNS])**

(24) DATE Date key

When performing number of days calculation, press this key after inputting numbers for year, month and date. **(Symbolized here as [DATE])**

(25) $\sqrt{\ }$ Square root key

To calculate the square root of displayed number, press this key. **(Symbolized here as [√])**

(26) log Common logarithm key

To find the common logarithm of displayed number, press this key. **(Symbolized here as [log])**

(27) x^y Power raising key

To raise the base x to yth power. **(Symbolized here as [x^y])**

2/POINTS OF CAUTION

* Since the unit contains precise electronic components, never attempt to disassemble it. For servicing contact your retailer or a nearby dealer.
* Be careful not to drop the unit or handle it roughly. Avoid operating the keys roughly.
* Avoid using the unit in extreme temperatures (below 32°F or 0°C, or above 104°F or 40°C). Also protect the unit from extremely dusty or humid conditions.
* To clean the unit, use a soft, dry cloth or slightly damp cloth with neutral detergent to wipe it off. Never use thinner, benzine type solvents or alcohol for cleaning.

3/BATTERY MAINTENANCE

When battery power decreases, the whole display darkens. Battery should then be renewed. Be sure to switch OFF the power before changing. For battery specifications, see page 57.

Replacement of battery:

1) Slide open the battery compartment lid on the back of the unit.
2) Remove dead battery and insert new battery with the plus terminal (flat side) on top.

3) Replace the battery compartment lid.

* Before inserting new battery, be sure to thoroughly wipe it off with a dry cloth to maintain good contacts.
* Never leave dead battery in the battery compartment.
* Remove battery when not using for an extended period.
* It is recommended that battery be replaced every 2 years to prevent the chance of malfunctions due to battery leakage.

Note: For initial operation after battery replacement, turn the power switch on and off twice (i.e. ON-OFF-ON).

4/BEFORE USING THE CALCULATOR

■ Correction

* If you are aware of data entry error before pressing a command key, press [C] and re-input the correct data.
* If you have pressed [+], [−], [×] or [÷] by mistake, you may press the correct key immediately.

■ Overflow or error check

Overflow or error is indicated by the "E" sign and stops further calculations.

Overflow or error occurs:

1) When the integer part of an answer, whether intermediate or final, exceeds 10 digits. However, the significant 10 digits of the answer are given and the decimal point indicates that the true decimal position is 10 digits to the right.
2) When the integer part of an accumulated total in the memory exceeds 10 digits.
3) When a number is divided by 0 (zero).
4) When function calculation or financial calculation is performed with a number exceeding the input range (see page 54 to 56).

To release the overflow or error check, press the AC or C key: AC for starting a new calculation, and C for continuing the calculation, which clears only the "E" sign.

■ Auto power off function

If the calculator is left with the power switch at the ON position, the auto power off function automatically turns off the power in approximately 6 minutes, thus saving battery life.

Power is resumed either by pressing the AC key or by re-operating the ON-OFF switch.

5/BASIC CALCULATIONS

5-1 Four Basic Calculations

EXAMPLE	OPERATION	READ-OUT
53+123−63=113	53 + 123 − 63 =	113.
0.456×(−89)÷12=−3.382	÷ 456 × 89 +/− + 12 =	−3.382
(56×3−89)÷5.2+63 =78.19230769.....	56 × 3 − 89 + 5 ÷ 2 + 63 =	78.19230769

5-2 Constant Calculations

EXAMPLE	OPERATION	READ-OUT
3+2.3=5.3	2 ÷ 3 + + 3 =	K 5.3
6+2.3=8.3	6 =	K 8.3

EXAMPLE	OPERATION	READ-OUT
$7-\underline{5.6}=1.4$	5 ÷ 6 − − 7 =	K 1.4
$-4.5-\underline{5.6}=-10.1$	4 ÷ 5 +/− =	K −10.1
$2.3\times\underline{12}=27.6$	12 × × 2 ÷ 3 =	K 27.6
$(-9)\times\underline{12}=-108$	9 +/− =	K −108.
$74\div\underline{2.5}=29.6$	2 ÷ 5 + + 74 =	K 29.6
$85.2\div\underline{2.5}=34.08$	85 ÷ 2 =	K 34.08
$17+17+17+17=68$	17 + + =	K 34.
	=	K 51.
	=	K 68.
$1.7^2=2.89$	1 ÷ 7 × × =	K 2.89
$1.7^3=4.913$	=	K 4.913
$1.7^4=8.3521$	=	K 8.3521

$\frac{1}{4}=0.25$

$\frac{1}{4^2}=0.0625$

	4 + + 1 =	K 0.25
	=	K 0.0625

5-3 Percentage Calculations

EXAMPLE	OPERATION	READ-OUT
12% of 1500 180	1500 × 12 %	180.
Percentage of 660 against 880 . . . . . 75%	660 + 880 %	75.
15% add-on of 2500 2875	2500 × 15 % +	2875.
25% discount of 3500 2625	3500 × 25 % −	2625.
If you made \$80 last week and \$100 this week, what is the percent increase?	100 − 80 %	25. (%)

EXAMPLE	OPERATION	READ-OUT
12% of 1200 144	1200 × × 12 %	K 144.
18% of 1200 216	18 %	K 216.
23% of 1200 276	23 %	K 276.

Mark-up
What will the selling price and profit be when the purchasing price of an item $480 and the profit rate to the selling price is 25%?

480 + 25 % → 640. (Selling price)

(Subsequently) − → 160. (Profit)

Mark-down
What will the bargain price and loss be if a $130 item is sold at a loss rate of 4% of the bargain price?

130 + 4 +/− % → 125. (Bargain price)

(Subsequently) − → −5. (Loss)

5-4 Memory Calculations

* The contents of the memory will be retained even after the power is turned OFF.
* When a new number is entered into the memory by M↦ key, the previous number stored is automatically cleared and the new number is put in the memory.
* To clear the contents, press AC M↦ or 0 M↦ in sequence.

EXAMPLE	OPERATION	READ-OUT
53+6= 59	53 + 6 − M↦	M 59.
23−8= 15	23 − 8 M+	M 15.
56×2=112	56 × 2 M+	M 112.
+) 99÷4= 24.75	99 + 4 M+	M 24.75
210.75	MR	M 210.75

7+7−7+(2×3)+(2×3)+(2×3)−(2×3)=19

7 M↦ M+ M− 2 × 3 M+ M+ M+ M− MP → M 19.

EXAMPLE	OPERATION	READ-OUT
$12\times\underline{3}=\ 36$ $-)\ 45\times\underline{3}=135$ $78\times\underline{3}=234$ 135	3 × × 12 = M+	M K 36.
	45 M−	M K 135.
	78 M+	M K 234.
	MR	M K 135.
$\frac{9\times6+3}{8\times(7-2)}=1.425$	7 − 2 × 8 = M+	M 40.
	9 × 6 + 3 + MR =	M 1.425

5-5 Date Calculations

* Input for date calculation is limited to January 1, 1901 through December 31, 2099.
* Date calculations are computed by using only the last 2 digits of the year, when the calendar range is 1901 to 1999. Enter full four digits for years, 2000 to 2099.

EXAMPLE	OPERATION	READ-OUT
What will the day of the week be on Jan. 1, 1982?	82 DATE =	82–01–01 5 (Friday)*

* See page 3 on day of the week.

What will the day of the week be on Mar. 1, 1990?	90 DATE 3 =	90–03–01 4 (Thu.)

* When pressing =, +, −, × or + key after inputting year (or year & month), the first date of the year (or month) will be displayed.

What will the day of the week be on Dec. 31, 2001?	2001 DATE 12 DATE 31 DATE	01 12 31 1 (Mon.)
How many days are there from Oct. 20 to Dec. 13, 1981?	81 DATE 12 DATE 13 =	81–12–13 0
	81 DATE 10 DATE 20 =	54.

EXAMPLE	OPERATION	READ-OUT
What date and day of the week will the 200th day from Jul. 7, 1981 be?	81 DATE 7 DATE 7 +	81-07-07 2
	200 =	82-01-23 6
What date and day was it 45 days prior to Jun. 10, 1981?	81 DATE 6 DATE 10 −	81-06-10 3
	45 =	81-04-26 0
What dates will the 50th, 100th and 150th day from Apr. 7, 1982 be?	82 DATE 4 DATE 7 + +	K 82-04-07 3
	50 =	K 82-05-27 4
	100 =	K 82-07-16 5
	150 =	K 82-09-04 6

* A date can be stored into the memory.

5-6 Function Calculations ($\sqrt{\ }$, log, x^y)

EXAMPLE	OPERATION	READ-OUT
$\sqrt{5}=2.236067977$	5 $\sqrt{\ }$	2.236067977
$\sqrt[4]{81}=3$	81 $\sqrt{\ }$ $\sqrt{\ }$	3.
$(\sqrt{2}+\sqrt{3})\times 3=9.43879311$	2 $\sqrt{\ }$ + 3 $\sqrt{\ }$ + 3 =	9.43879311
$\log 1.23\ (=\log_{10}1.23)=0.089905111$	1 ÷ 23 log	0.089905111
$(\log 147+\log 52)\times 4=15.53328272$	147 log + 52 log + 4 =	15.53328272
$10^{1.23}=16.98243652$	10 x^y 1 ÷ 23 =	16.98243652

(Obtain the antilogarithm of log 1.23.)

EXAMPLE	OPERATION	READ-OUT
$5.6^{2.3}=52.58143837$	5 ⊡ 6 x^y 2 ⊡ 3 =	52.58143837
$4^{2.5}=32$	2 ⊡ 5 x^y x^y 4 =	K 32.
$0.16^{2.5}=0.01024$	⊡ 16 =	K 0.01024
$9^{2.5}=243$	9 =	K 243.
$(78-23)^{-3}=0.000006011$	78 − 23 x^y 3 +/− =	0.000006011
$2\times3.4^{(5\cdot6.7)}=3306232$	5 + 6 ⊡ 7 = M+ 3 ⊡ 4 x^y MR × 2 =	M 3306232.

6/FINANCIAL CALCULATIONS

- Press the MODE key and set the mode which corresponds to the type of desired financial calculation.
- When you start to calculate, press INV AC/fc to clear the memory for financial calculation. (AC will not clear the memory)
- When making inputs with each key, press the ENT key after putting in the numbers then press each key. Also, to find the calculated result, press each key after the AMS key.
- Contents of input data can be checked by directly pressing each key.
- Input interest rate by i% key as a percentage rate.
- Input number of periods and interest rate should correspond.
  If number of periods is in years, interest rate should be the yearly interest rate.
  If number of periods is in months, interest rate should be the monthly interest rate.
  If number of periods is in days, interest rate should be the daily interest rate.

Notes: a) It may take a long time to calculate the interest rate. In this case, to stop the calculation while in progress, keep pressing the AC key until the display goes to 0.
b) If the result of the calculation is too great a number, an error display ("E") will appear. This can be cleared by pressing C or AC. However, the financial calculation memory will retain the stored value.

6-1 Compound Interest Calculations

- Compound interest calculation is performed in the INT mode (press MODE key until "INT" is displayed).
- Financial keys used for compound interest calculation are INT, n, i%, PV and FV.
- Each data element can be calculated as follows:

Total amount of principal and interest $FV = PV\,(1+i)^n$

Principal $PV = FV\,(1+i)^{-n} = \dfrac{FV}{(1+i)^n}$

Number of periods $n = \dfrac{\log\left(\frac{FV}{PV}\right)}{\log\,(1+i)}$

Interest rate $i\% = \left\{\left(\frac{FV}{PV}\right)^{1/n} - 1\right\} \times 100$

Interest $I = PV\,(1+i)^n - PV$

1. Total amount of principal and interest

Example 1 – What is the total amount of principal and interest on a $5,000 principal at 6% annual interest compounded annually over a period of 7 years?

	OPERATION	READ-OUT
Press MODE key until "INT" is displayed. (same for below)		
"INT"	INV FC	0.
(number of years)	7 ENT n	7.
(annual interest)	6 ENT i%	6.
(principal)	5000 ENT PV	5000.
(total amount of principal and interest)	ANS FV	7518.151295

* Data may be input in any sequence. (same for below)

Example 2 – Recalculate Example 1 for semiannual compounding of interest.

	OPERATION	READ-OUT
"INT"	INV FC	0.
	7 × 2 = ENT n	14.
	6 ÷ 2 = ENT i%	3.
	5000 ENT PV	5000.
	ANS FV	7562.948624

2. Compound interest initial deposit

Example – How much principal must be initially deposited to accumulate $10,000 at the end of 2 years if the annual interest rate is 4% and principal and interest are compounded every 3 months?

	OPERATION	READ-OUT
"INT"		
	INV P/C FC	0.
(period)	2 × 4 = ENT 12	8.
(interest rate)	4 ÷ 4 = ENT %	1.
(total amount of principal and interest)	10000 ENT FV	10000.
(initial deposit)	ANS PV	9234.832225

3. Compound interest investment

Example – What is the interest rate required to receive a return of $7,000 on a $4,000 investment if the money is invested for 10 years and principal and interest are compounded annually?

	OPERATION	READ-OUT
"INT"	INV P/C FC	0.
(period)	10 ENT 12	10.
(principal)	4000 ENT PV	4000.
(total amount of principal and interest)	7000 ENT FV	7000.
(interest rate)	ANS %	5.755705034

4. Compound interest period

Example – How many years will it take to reach $10,000 if you deposit $500 at 5.4% annual interest compounded monthly?

	OPERATION	READ-OUT
"INT"	INV P/C FC	0.
(monthly rate)	5 . 4 ÷ 12 = ENT %	0.45
(principal)	500 ENT PV	500.
(total amount of principal and interest)	10000 ENT FV	10000.
(period . . . . number of months)	ANS 12	667.215
(number of years)	÷ 12 =	55.60125

5. Interest calculation

Example – What is the amount of interest after two years if you invest $5,000 at 5% annual interest and interest is compounded every 3 months.

"INT"	OPERATION	READ-OUT
(period)	[INV] [C/CE]	0.
(interest rate)	2 [+] 4 [=] [ENT] [n]	8.
(principal)	5 [+] 4 [=] [ENT] [i/Y]	1.25
(interest)	5000 [ENT] [PV]	5000.
	[ANS] [INT]	522.4305055

6. Conversion from nominal interest rate to effective interest rate

Example – What is the effective interest rate for a nominal interest rate of 12% annual interest compounded every 3 months?

"INT"	OPERATION	READ-OUT
(period)	[INV] [C/CE]	0.
(nominal interest rate)	4 [ENT] [n]	4.
(assumed principal)	12 [+] 4 [=] [ENT] [i/Y]	3.
(effective interest rate)	100 [ENT] [PV]	100.
	[ANS] [INT]	12.55088099

7. Conversion from effective interest rate to nominal interest rate

Example – What is the nominal interest rate for an effective interest rate of 12.55% compounded every 3 months?

"INT"	OPERATION	READ-OUT
(period)	[INV] [C/CE]	0.
(assumed principal)	4 [ENT] [n]	4.
(assumed total amount of principal and interest)	100 [ENT] [PV]	100.
(quarterly interest rate)	[+] 12 [÷] 55 [=] [ENT] [FV]	112.55
(annual interest rate)	[ANS] [i/Y]	2.999798439
	[+] 4 [=]	11.99919376

6-2 Loan Calculations

- Loan calculation is performed using the LOAN mode (Press the [MODE] key until LOAN is displayed.)
- Loan calculation can be performed using either end of period payments or beginning of period payments. Press [INV] and [MODE] to select "BGN" or "END".
- Each data element can be obtained by the following formulas:

End of period payment

Principal (amount borrowed)

$$PV = PMT \cdot \frac{1-(1+i)^{-n}}{i} = PMT \cdot \frac{(1+i)^{n}-1}{i \cdot (1+i)^{n}}$$

Payment

$$PMT = PV \cdot \frac{i}{1-(1+i)^{-n}} = PV \cdot \frac{i \cdot (1+i)^{n}}{(1+i)^{n}-1}$$

Number of periods

$$n = \frac{\log\left(1 - i \cdot \frac{PV}{PMT}\right)}{\log(1+i)}$$

Interest rate

Approximation formulas by Newton's Law

Beginning of period payment

Principal (amount borrowed)

$$PV = PMT \cdot (1+i) \cdot \frac{1-(1+i)^{-n}}{i}$$

Payment

$$PMT = \frac{PV}{1+i} \cdot \frac{i}{1-(1+i)^{-n}} = \frac{PV}{(1+i)} \cdot \frac{i \cdot (1+i)^{n}}{(1+i)^{n}-1}$$

Number of periods

$$n = \frac{\log\left(1 - \frac{i}{1+i} \cdot \frac{PV}{PMT}\right)}{\log(1+i)}$$

Interest rate

Approximation formulas by Newton's Law

1. Borrowing money

Example – How much can be borrowed if you have a $450 per month payback capability and the annual interest rate is 7.5% and the payback period is 15 years?

	OPERATION	READ-OUT
"LOAN, END " . . . . . end of payment period (same for below)		
Press INV and MODE to display "END" (same for below)		
(payment)	INV AC FC	0.
	450 ENT PMT	450.
(interest rate)	7 ÷ 5 + 12 = ENT i%	0.625
(period)	15 × 12 = ENT n	180.
(amount that can be borrowed)	ANS PV	48543.04208
"LOAN, BGN " . . . . . beginning of payment period (same for below)		
	INV MODE	48543.04208
(amount that can be borrowed)	ANS PV	48846.43609

* " END " or " BGN " can be selected at any time without affecting the calculation function.

2. Payback

Example – What will be the monthly payment on a loan of $2,000 borrowed for 24 months at a 6% annual interest rate with interest compounded monthly?

	OPERATION	READ-OUT
"LOAN, END "		
(period)	INV AC FC	0.
	24 ENT n	24.
(interest rate)	6 ÷ 12 = ENT i%	0.5
(amount borrowed)	2000 ENT PV	2000.
(monthly payment)	ANS PMT	88.64122051
"LOAN, BGN "		
	INV MODE	88.64122051
(monthly payment)	ANS PMT	88.20021941

3. Loan payment period

Example – How long will it take to pay back a loan of $30,000 borrowed at a 5.5% annual interest rate by making a monthly payment of $420?

	OPERATION	READ-OUT
"LOAN, END "		
	INV FC	0.
(amount borrowed)	30000 ENT PV	30000.
(monthly payment)	420 ENT PMT	420.
(interest rate)	5 ÷ 5 + 12 = ENT I%	0.458333333
(period. . . . number of months)	ANS N	86.72384
(period. . . . number of years)	+ 12 =	7.226986667
"LOAN, BGN "		
	INV MODE	7.226986667
(period. . . . number of months)	ANS N	86.23877
(period. . . . number of years)	+ 12 =	7.186564167

4. Effective interest rate

Example – What is the annual interest rate for a $50,000 loan when paid back at $640 per month over a period of 25 years?

	OPERATION	READ-OUT
"LOAN, END "		
	INV FC	0.
(period)	25 × 12 = ENT N	300.
(monthly payment)	640 ENT PMT	640.
(amount borrowed)	50000 ENT PV	50000.
(interest rate. . . . monthly)	ANS I%	1.249107827
(interest rate. . . . annual)	× 12 =	14.98929392
"LOAN, BGN "		
	INV MODE	14.98929392
(interest rate. . . . monthly)	ANS I%	1.266498816
(interest rate. . . . annual)	× 12 =	15.19798579

6-3 Annual Payments

- Annual payment is performed by inputting amount borrowed (PV), number of periods (n), and interest rate (i%), and by calculating monthly payment (PMT) in the "LOAN" mode. Interest portion (INT) and principal portion (PRN) of a monthly amortized loan, and remaining balance (BAL) are calculated in the "AMORT" mode. (Press the MODE key until "AMORT" is displayed.)
- Either input or output of PV, i%, n and PMT can be accomplished. However, INT, PRN and BAL must be determined by calculating.
- Monthly INT, PRN and BAL can be determined by using the following formulas.

$INT_n = BAL_{n-1} \cdot i$ $\quad PRN_n = PMT - INT_n$ $\quad BAL_n = BAL_{n-1} - PRN_n$

Example — What is the monthly payment on a loan of $40,000 borrowed for the purpose of buying a house at a 10% annual interest rate for 15 years? Also, find the INT, PRN and BAL for the 1st and 2nd monthly payments.

	OPERATION	READ-OUT
"LOAN, END"	INV C/CE i%	0.
(amount borrowed)	40000 ENT PV	40000.
(period)	15 × 12 = ENT n	180.
(interest rate)	10 ÷ 12 = ENT i%	0.833333333
(monthly payment)	ANS PMT	429.842047

"AMORT"

(continuing)	MODE MODE	429.842047
(1st month)	1 ENT n	1.
(payment to interest)	ANS INT	333.3333332
(payment to principal)	ANS PRN	96.5087138
(remaining balance)	ANS BAL	39903.49129
(2nd month)	2 ENT n	2.
	ANS INT	332.5290939
	ANS PRN	97.3129531
	ANS BAL	39806.17833

* By repeating this operation, an amortization schedule of each month's payment to interest, payment to principal and remaining balance can be made.

AMORTIZATION SCHEDULE

Amount borrowed	$40,000
Annual interest rate	10%
Payment period	15 years

Number of payment	Payment to principal	Payment to interest	Total payment	Remaining principal balance
1	96.5087138	333.3333332	429.842047	39903.49129
2	97.3129531	332.5290939	429.842047	39806.17833
3	98.12389437	331.7181526	429.842047	39708.05444
4	98.94159349	330.9004535	429.842047	39609.11284
5	99.76610677	330.0759402	429.842047	39509.34674
⋮	⋮	⋮	⋮	⋮
175	408.9631245	20.8789225	429.842047	2096.50759
176	412.3711506	17.4708964	429.842047	1684.13643
177	415.8075768	14.0344702	429.842047	1268.32885
178	419.2726399	10.5694071	429.842047	849.05622
179	422.7665786	7.0754684	429.842047	426.28963
180	426.2896334	3.5524136	429.842047	0.

6-4 Bonus Payments

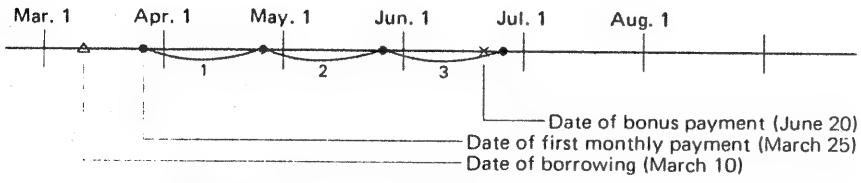
- Bonus payment calculation is performed in the "BNS" mode (press MODE key until "BNS" is displayed).
- Data required are interest rate (I%), number of months (n), amount borrowed (PV), number of days from the date of the borrowing to the 1st payment date (d), amount of bonus payment (BNS), number of monthly payments made before 1st bonus payment is made (m)* (see the note below indicated by*).
  Output is monthly payment amount (PMT) only.
- Number of months (m) and number of days (d) must be 1 or 2 digit integers ($n \geqq m$).
- Monthly payment is calculated using the following formula.

$$PMT = \frac{i \cdot (1+i)^n}{(1+i)^n - 1} \cdot \left\{ PV \cdot \left(1 + \frac{d}{30} \cdot i\right) - (1+i)^{-6\ell} \cdot \frac{BNS}{(1+i)^m} \cdot \frac{(1+i)^{6\ell} - 1}{(1+i)^6 - 1}(1+i)^{6\ell} \right\}$$

$$\ell = \text{INTEGER}\left(\frac{n-m}{6}\right) + 1$$

* In counting the number of months before the first bonus payment, start from the date of the first monthly payment.

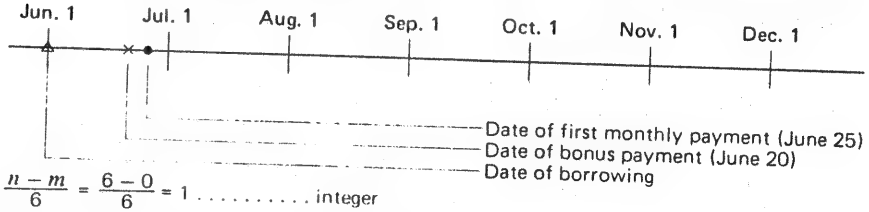
Example – If you borrow on March 10, and make monthly payment on every 25th, and first bonus payment on June 20:



For the period between March 25 and April 24, $m = 1$;
for the period between April 25 and May 24, $m = 2$;
for the period between May 25 and June 24, $m = 3$.

In the formula to calculate ℓ, the number of bonus payments, if $\frac{n-m}{6}$ is an integer (0, 1, 2, ...), the next bonus payment is included in the calculation.

Example – If the first bonus payment is earlier than the first monthly payment, and you are paying back in six months:



$\frac{n-m}{6} = \frac{6-0}{6} = 1$ . . . . . integer

This makes ℓ, the number of bonus payments, two.

* You may want to reduce the number of bonus payments by one when $\frac{n-m}{6}$ is an integer. Or you may want to input 0 (zero) for m. If so, input $m + 1$ for m, and BNS $(1 + i)$ for BNS.

Example – What is the monthly payment when $40,000 is borrowed on March 10, annual interest rate is 6.7%, repayment period is 10 years and a bonus payment of $1,000 is to be paid twice a year?
Assume that: 1) each monthly payment is made on the 25th of the month; and 2) the first bonus payment is made on June 20.

	OPERATION	READ-OUT
"BNS"	[INV] [AC/FC]	0.
(amount borrowed)	40000 [ENT] [PV]	40000.
(interest rate)	6 [÷] 7 [+] 12 [=] [ENT] [i%]	0.558333333
(period)	10 [×] 12 [=] [ENT] [n]	120.
(bonus payment)	1000 [ENT] [BNS]	1000.
(number of months)	3 [ENT] [m]	3.
(number of days)	15 [ENT] [d]	15.
(monthly payment)	[ANS] [PMT]	290.8048549

6-5 Installment Savings

- Installment savings is calculated in the "SF" mode. (Press the [MODE] key until "SF" is displayed) However, if an initial deposit is made, use "INT" mode to input the number of periods and the interest rate.
- Installments can be calculated when paid at the beginning of the period or at the end of the period by pressing [INV] [MODE] to display "BGN" or "END".

- Each data element is obtained using the following formulas.

Beginning of period payment

Total amount of principal and interest $FV = PMT \cdot (1+i) \cdot \dfrac{(1+i)^n - 1}{i}$

Deposit amount $PMT = \dfrac{FV}{(1+i)} \cdot \dfrac{i}{(1+i)^n - 1}$

Period $n = \dfrac{\log\left(\dfrac{i}{1+i} \cdot \dfrac{FV}{PMT} + 1\right)}{\log(1+i)}$

Interest rate Approximation formulas by Newton's Law

End of period payment

Total amount of principal and interest $FV = PMT \cdot \dfrac{(1+i)^n - 1}{i}$

Deposit amount $PMT = FV \cdot \dfrac{i}{(1+i)^n - 1}$

Period $n = \dfrac{\log\left(i \cdot \dfrac{FV}{PMT} + 1\right)}{\log(1+i)}$

Interest rate Approximation formulas by Newton's Law

1. Installment savings total amount of principal and interest

Example – What is the total amount of principal and interest when deposits are $100 per month, annual interest rate is 6% and number of years is 5 years with interest compounded monthly?

"SF, BGN "	OPERATION	READ-OUT
(period)	INV 4dec FC	0.
(interest rate)	5 × 12 = ENT 7t	60.
(deposit amount)	6 ÷ 12 = ENT i%	0.5
(total amount of principal and interest)	100 ENT PMT	100.
"SF, END "	ANS FV	7011.888066
(total amount of principal and interest)	INV MODE	7011.888066
	ANS FV	6977.003051

2. Installment savings monthly deposit

Example – What is the installment savings monthly deposit required to accumulate a savings of $5,000 over a 10 year period when the annual interest rate is 6% and is compounded monthly?

"SF, BGN "	OPERATION	READ-OUT
(period)	INV 4dec FC	0.
(interest rate)	10 × 12 = ENT 7t	120.
(total amount of principal and interest)	6 ÷ 12 = ENT i%	0.5
(monthly deposit)	5000 ENT FV	5000.
"SF, END "	ANS PMT	30.35845868
(monthly deposit)	INV MODE	30.35845868
	ANS PMT	30.51025097

3. Installment savings number of deposits

Example – What are the number of monthly deposits required to accumulate $10,000 in savings by depositing $200 per month at an annual interest rate of 6% compounded monthly?

	OPERATION	READ-OUT
"SF, BGN"	INV 2nd FC	0.
(interest rate)	6 ÷ 12 = ENT i%	0.5
(monthly deposit)	200 ENT PMT	200.
(total amount of principal and interest)	10000 ENT FV	10000.
(period. . . . . number of months)	ANS n	44.54059
(period. . . . . number of years)	÷ 12 =	3.711715833
"SF, END"	INV MODE	3.711715833
(period. . . . . number of months)	ANS n	44.74019
(period. . . . . number of years)	÷ 12 =	3.728349167

4. Installment savings interest

Example – What is the interest rate required to accumulate a total amount of principal and interest of $8,000 by making monthly deposits of $50 per month for a period of 10 years?

	OPERATION	READ-OUT
"SF, BGN"	INV 2nd FC	0.
(period)	10 × 12 = ENT n	120.
(monthly deposit)	50 ENT PMT	50.
(total amount of principal and interest)	8000 ENT FV	8000.
(interest rate. . . . . monthly)	ANS i%	0.456062825
(interest rate. . . . . annual)	× 12 =	5.4727539
"SF, END"	INV MODE	5.4727539
(interest rate. . . . . monthly)	ANS i%	0.46309817
(interest rate. . . . . annual)	× 12 =	5.55717804

5. Installment savings (when an initial deposit is made)

Example – What is the total amount of savings at the end of 1 year when an initial deposit is made and then monthly deposits of $250 are made at the end of each month at a 4.5% annual interest rate compounded monthly?

	OPERATION	READ-OUT
"INT"	[INV] [AC/FC]	0.
(period)	12 [ENT] [n]	12.
(interest rate)	4 [÷] 5 [+] 12 [=] [ENT] [i%]	0.375
(initial deposit)	500 [ENT] [PV]	500.
(total amount of principal and interest)	[ANS] [FV] [M+]	M 522.9699125
"SF, [END] "*		
	[MODE] [MODE]	M 522.9699125
(monthly deposit)	250 [ENT] [PMT]	M 250.
	[n]	M 12.
	[i%]	M 0.375

(total amount of principal and interest)	[ANS] [FV] [M+]	M 3062.655002
(grand total)	[MR]	M 3585.624915

* For end of month deposits, use end of period " [END] " function.

6-6 Deferred annuity present values

- Future value ([FV]), deferral period ([n]) and interest rate ([i%]) are input using the "INT" mode. Payment ([PMT]) and payment period input as well as present value calculation are performed using the "LOAN" mode.
- Deferred annuity present value can be calculated using either beginning of period payments or end of period payments by pressing [INV] [MODE] to display " [BGN] " or " [END] ".

Example – What is the present value of a 2 year deferral future value that will provide an income of $300 per year for a period of 8 years after 2 years at an annual interest rate of 7% compounded annually?

	OPERATION	READ-OUT
"INT"	[INV] [AC FC]	0.
(future value)	300 [ENT] [FV]	300.
(deferral period)	2 [ENT] [n]	2.
(interest rate)	7 [ENT] [i%]	7.
(present value)	[ANS] [PV]	262.0316185
"LOAN, END"	[MODE]	262.0316185
	[ENT] [PMT]	262.0316185
(payment period)	8 [ENT] [n]	8.
(present value)	[ANS] [PV]	1564.669012
"LOAN, BGN"	[INV] [MODE]	1564.669012
(present value)	[ANS] [PV]	1674.195843

7/APPLICATIONS

Example 1 — Invoice Calculation

Nomen-clature	Items per box	Number of boxes	Price per item	Total price
A	12	7	$450	$37,800
B	50	6	75	22,500
C	—	25	580	14,500
	Total			74,800
	3% sales tax			2,244
	Transportation charge			1,350
	Total invoice amount			$78,394

OPERATION	READ-OUT
12 [×] 7 [×] 450 [−] [M−]	M 37800.
50 [×] 6 [×] 75 [M+]	M 22500.
25 [×] 580 [M+]	M 14500.
[MR]	M 74800.
[×] 3 [%] [M+]	M 2244.
1350 [M+]	M 1350.
[MR]	M 78394.

Example 2 — Pro-rating

Class	Sales	Percentage of total
A	$ 84	22.4 %
B	153	40.8
C	138	36.8
Total	$375	100.0 %

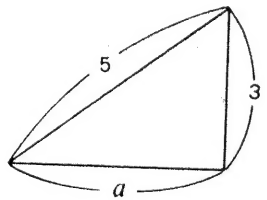
OPERATION	READ-OUT
84 + 153 + 138 =	375.
+ 100 + +	3.75
84 − Mr	22.4
153 M+	40.8
138 M+	36.8
MR	100.

Example 3 — Proportional Distribution Calculation

Class	Proportional distribution	Price
A	28	$ 1,820
B	37	2,405
C	46	2,990
D	90	5,850
Total	201	$13,065

OPERATION	READ-OUT
28 + 37 + 46 + 90 =	201.
+ + 13065 − × × 28 − Mr	1820.
37 M+	2405.
46 M+	2990.
90 M+	5850.
MR	13065.

Example 4 – Pythagorean Theorem



$$a = \sqrt{5^2 - 3^2} = 4$$

OPERATION	READ-OUT
5 × = M+	M 25.
3 × M−	M 9.
MR √	M 4.

Example 5 – Find the monthly payment and mark up for a loan of $10,000 with 24 equal payments and an annual interest rate of 17.5%. However, monthly payment is in dollar units and the total fractional payments are added to the first payment.

"LOAN, END"

OPERATION	READ-OUT
INV d/c F/C 24 ENT n	24.
17 ÷ 5 + 12 = ENT i%	1.458333333
10000 ENT PV	10000.
ANS PMT	496.8284792

For this answer, the monthly payment will be $496.
Also, the 1st payment will be:
(continuing)

OPERATION	READ-OUT
− 496 × 24 + 496 =	515.8835008

Mark up:
(continuing)

OPERATION	READ-OUT
M+	M 515.8835008
496 × 23 M+	M 11408.
10000 M−	M 10000.
MR	M 1923.8835

■ Financial Calculation Unit Capacity

Key \ Mode		INT	LOAN	SF	AMORT	BNS
n	Input/Output range	$0 \leq x < 10^{10}$	$0 \leq x < 10^{10}$	$0 \leq x < 10^{10}$	$0 \leq x < 10^{10}$	$0 \leq x < 10^{10}$
	Accuracy	7th digit +1	7th digit +1 ($i/\% \geq 10^{-3}$) (1st to 6th digit +1 ($10^{-3} > i/\% \geq 10^{-9}$))			–
i%	Input/Output range	$-100 \leq x < 10^{10}$	$-100 < x < 10^{10}$	$-100 < x < 10^{10}$	$-100 < x < 10^{10}$	$-100 < x < 10^{10}$
	Accuracy	7th digit +1	4th digit +1 (When n = 6 to 360 and $i/\%$ = 0.52 to 1.48: 6th digit +1)	4th digit +1 (When n = 6 to 360 and $i/\%$ = 0.2 to 1.16: 6th digit +1)	–	–
PMT	Input/Output range	–	$0 \leq x < 10^{10}$	$0 \leq x < 10^{10}$	$0 \leq x < 10^{10}$	$0 \leq x < 10^{10}$
	Accuracy		10th digit +1 ($n \geq 1$, $i/\% \geq 10^{-3}$) (When $10^{-3} > i/\% \geq 10^{-9}$: 6th to 9th digit +1; When n < 1: 1st to 9th digit +1)			10th digit +1 ($i/\% \geq 10^{-3}$) (When $10^{-3} > i/\% \geq 10^{-9}$: 8th to 9th digit +1)
PV	Input/Output range	$0 \leq x < 10^{10}$	$0 \leq x < 10^{10}$		$0 \leq x < 10^{10}$	$0 \leq x < 10^{10}$
	Accuracy	10th digit +1 (When $i/\% < 10^{-9}$: 7th digit +1)	10th digit +1 ($n < 1$, $i/\% \geq 10^{-3}$) (When $10^{-3} > i/\% > 10^{-9}$: 6th to 9th digit +1; When n < 1: 1st to 9th digit +1)		–	

Key \ Mode		INT	LOAN	SF	AMORT	BNS
FV	Input/Output range	$0 \leq x < 10^{10}$	–	$0 \leq x < 10^{10}$	$0 \leq x < 10^{10}$	
	Accuracy	10th digit +1 (When $i/\% < 10^{-9}$: 7th digit +1)	–	10th digit +1 ($n < 1$, $i/\% < 10^{-3}$) (When $10^{-3} > i/\% > 10^{-9}$: 8th to 9th digit +1; When n < 1: 1st to 9th digit +1)		–
BNS	Input/Output range	–				$0 \leq x < 10^{10}$
	Accuracy				–	–
INT	Input/Output range	$0 \leq x < 10^{10}$	–	–	$0 \leq x < 10^{10}$	–
	Accuracy	–	–	–	8th digit +1	–
BAL	Input/Output range	–		–	$0 \leq x < 10^{10}$	–
	Accuracy				8th digit +1	
n	Input/Output range					*$1 \leq x < 10^{7}$
	Accuracy	–	–	–		–
PRN	Input/Output range	–		–	$0 \leq x < 10^{10}$	
	Accuracy				8th digit +1	
d	Input/Output range	–				*$1 \leq x < 10^{7}$
	Accuracy					

*n and d setups only

8/SPECIFICATIONS

Type: BF-100

Basic calculations:
Addition, subtraction, multiplication, division, constants for +/−/x/÷, percentage calculation, memory calculation and date calculation.

Function calculations:
Square root, logarithm and power.

• Function calculation capacity

	Input range	Output accuracy
$\sqrt{\ }$	$x \geq 0$	10th digit ±1
log	$x > 0$	
x^y	When $x < 0$, $y \rightarrow$ Natural number	

• When the answer is more than 10^{10}, accuracy is 9th digit ±1.

Financial calculations:
Compound interest calculation, loan calculation, annual payment, bonus payment, installment saving and deferred annuity present value.

Capacity:
10 digits

Display:
Liquid crystal display

Overflow or error check:
Indicated by the "E" sign, locking the calculator.

Main component:
One chip LSI

Power consumption:
0.00043W

Power source:
One lithium battery (type: CR2025).
The calculator gives approximately 1,300 hours on type CR2025.

Ambient temperature range:
0°C – 40°C (32°F – 104°F)

Dimensions:
8.7H x 71.5W x 134mmD (3/8"H x 2-7/8"W x 5-1/4"D)

Weight:
60g (2.1 oz) including battery.